

Positive Train Control and Human Performance: Promise and Peril

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Why adopt PTC? (the promise)

- Solutions are needed to compensate for human error that contribute to accidents
- Emerging technology offers the promise of preventing human errors associated with train collisions, derailments, and roadway worker accidents

What kind of technology

- Digital communications
- Computer support
- Location finding

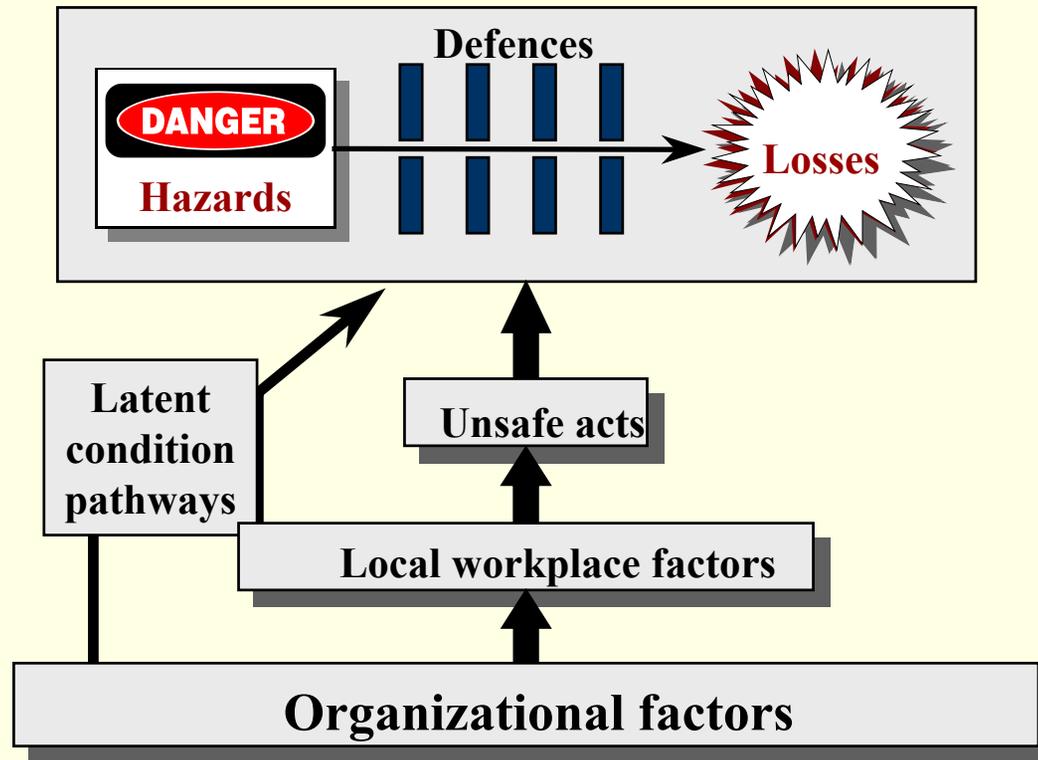
How would PTC improve safety?

- Use digital communications to reduce or eliminate voice radio communications
- Use automatic brake application to enforce train separation and speed restrictions
- Stop a train when a switch is improperly lined
- Use location finding technology to prevent train from entering work zone w/o permission.
- Use location finding technology to alert roadway worker when working outside work zone

Two approaches to PTC design

- Technology-Driven
 - Operator adapts to the technology
- Human-Centered
 - Technology is designed around the needs and limitations of the operator

One view of human error



From James Reason: Managing the Risks of Organizational Accidents (1997)

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What are the challenges (perils) to using PTC?

- Adds complexity
- Tighter coupling of interdependent elements and push for greater productivity can increase accident consequences
- Can take human out of the loop

How do challenges translate into operational concerns

- Overlay vs. vital system
- Interoperability
- Adaptation to unplanned events
- Maintenance
 - Selection and training of staff
 - Software version control

How can we respond to these challenges?

- Take a human-centered approach
- Involve operators in design process from planning stage thru to implementation
- Design system to accommodate human error and human performance limitations
- Provide adequate training
- Identify new sources of risk (human error)

FRA Research on PTC & Human Performance

- Function allocation
- Display Design
- Supervisory Control
- Workload transition
- Cognitive task analysis
- Human reliability analysis
- Human Centered Technology Evaluation Tool
- Roadway Worker Communication

FRA research products available

- Safety of High Speed Guided Ground Transportation Systems Human Factors Phase I: Function Analyses and Theoretical Considerations.
- Human Factors Phase II: Design and Evaluation of Decision Aids for Control of High-Speed Trains: Experiments and Model
- Human Factors Phase III: Effects of Train Control Technology on Operator Performance.
- Human Factors Phase IV: Risk Analysis Tool for New Train Control Technology.

FRA research products available continued

- Human Factors Guidelines for Locomotive Cabs
- Understanding How Train Dispatchers Manage and Control Trains - Results of a Cognitive Analysis
- Human Reliability Analysis in Support of Risk Assessment for Positive Train Control

FRA research products available continued

- Impact of Data Link Technology on Railroad Dispatching Operations
- Supporting Railroad Roadway Worker Communications with a Wireless Handheld Computer: Volume I - Usability for the Roadway Worker
- Supporting Railroad Roadway Worker Communications with a Wireless Handheld Computer: Volume II - Impact on Dispatcher Performance
- Human Reliability Analysis in Support of Risk Assessment for Positive Train Control

Where to find FRA research products

- www.fra.dot.gov/us/content/288
- www.volpe.dot.gov/opsad/pubs.html

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